



Understanding emergent teaching and learning practices: iPad integration in Polish school

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Abstract

The appearance of tablet technology in the classroom is considered an obvious modernisation milestone. In the last few years school professionals in Poland have made large investments in digitalisation, especially through one to one model (1:1), using digital devices such as tablets. Researches on tablet technology integration in school classrooms convince that digital technologies are closely related to the discourse of educational change. What *really* changes when digital technology is used in the classroom? This is a driving question for the present study. This research contributes knowledge and new insights into learning and teaching practices in two classrooms in a Polish primary school that were observed over a longer perspective of three school semesters. The design of teaching and learning with tablet technology was explored using the didactical design framework. This perspective focuses on both teachers' practices and students' learning activities in the classroom and how tablet technology is integrated into teaching and learning practices. Although the research project was performed on a small scale, it can be defined as one that documents the changes to learning and teaching practices happening in the traditional educational culture of the school under analysis. These changes were identified through the data collected by means of classroom video ethnography (63 teaching hours of recording) and follow-up interviews (18) with classroom's teachers. The analysis resulted in three distinct maps of emergent teaching and learning practices and a series of conflicts and tensions teachers experience in their everyday tablet-mediated teaching practices. The findings point out that tablet technology integration needs the alignment of the classroom pedagogy - technology relationships.

Keywords Tablet technology · Classroom pedagogy · Didactical design · Emergent teaching and learning practices · Change

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1 Introduction

The appearance of tablet technology in the classroom is leading to new opportunities for teaching and learning. It challenges and affects profoundly school everyday practices (Schatzki et al. 2011). In recent years, an increasing number of research studies explored the potential and the outcome of the use of tablet technology in schools (Bergström et al. 2019; Jahnke and Kumar 2014; Nouri and Cerrato Pargman 2016). Polish educational research related to this topic focuses on learning efficiency, improvement of learning outcomes, and students' motivation (Hojnacki 2011; Lewowicki and Siemieniecki 2012). The research works approach tablet technology as a new didactical resource, as a “supplement” to the established teaching and learning practices, used for the purposes of the traditional educational goals. Another type of research works explored the potential and implications of new tools and the new materiality for everyday teaching and learning practices (Säljö 2010; Cerratto Pargman and Jahnke 2019; Jahnke et al. 2017), the transformation of pedagogy, and the shaping of new digital competences, and twenty-first century skills such as creativity, critical thinking, ability to draw conclusions, data processing, interdisciplinarity, ability to cope with information and online resources, intercultural competences, project thinking, or virtual cooperation (Kopciwicz and Bougsiaa 2020; Pegrum 2014). Polish education research works assumed that the new material conditions for tablet-mediated teaching and learning may be a challenge to the traditional transmissive, frontal teaching model dominating in schools in Poland, and may give rise to conflicts between traditional and emergent new learning and teaching practices (Dylak 2013). The present research is related to the last type of assumptions. We attempt to document and describe teaching and learning practices that emerge with the use of tablet technology. Approaching teaching and learning practices opens up the opportunity to analyse how the school knowledge is shaped in the digital age (Cerratto Pargman and Jahnke 2019).

2 Theoretical framework

Research on tablet technology integration in school classrooms has a long tradition (Cerratto Pargman et al. 2017; Harper and Milman 2016). However, we didn't select theoretical perspectives that tend to overlook what teachers and students *actually do* with digital technologies in their everyday practices. For this research we used the didactical design framework (Bergström et al. 2019; Dylak 2013; Jahnke and Kumar 2014; Pachler et al. 2010) which is useful for studying design-in-practice. Dylak's (2013) didactical design theory was chosen to analyse the observable teaching and learning practices in the school classroom. This theory was supplemented by the SAMR model (Puentedura 2014), which permitted identifying how technology was integrated into classrooms. This theoretical approach was applied to analyse the empirical data collected through video ethnography.

2.1 Didactical design theory

The didactical design theory to which we refer in our research originates from the analyses of the advanced learning strategies developed by Dylak (2013). When analysing works

based on the tradition of European didactics, we note considerable similarity between the Dylak's theory and didactical design theory (Bergström et al. 2019, Jahnke et al. 2017). This framework includes three components: teaching, learning and the integration of technology. Didactical design encompasses many conceptual and methodological practices that provide both teaching and learning with the appropriate form and shape. Usually, the idea to design is connected with an intention to achieve an assumed didactic goal corresponding to a certain result. Didactical design covers many of the interrelated elements that have a mutual impact on one another. The central aspect of the didactical design is the combination of the practices of the teacher and students while the role of technology in the student's learning is strengthened. Didactical design embraces the mutual relationships among the following elements:

- type of learning objectives adopted;
- type of learning practices implemented;
- use of didactic resources, including technologies;
- student role;
- teacher role;
- assessment and feedback.

Therefore, Dylak's theory combines intentionality, practices, social relations and the roles of teachers and students, and didactic resources.

2.2 SAMR model developed by Puentedura

Didactical design was also supplemented with the Substitution Augmentation Modification Redefinition (SAMR) model (Puentedura 2014), which has focused on stages of technology integration and its ability to transform the existing teaching and learning practices. The SAMR model defines several levels of technology integration into the education process (substitution, augmentation, modification and redefinition). This model is helpful in understanding how the teacher adoption of technology influences and challenges the didactical design. In other words, the SAMR model highlights the goals of using technology in the classroom and the essence of "technology tasks".

Tablet integration may lead to new opportunities for teaching and learning within the classroom and the need for teachers to rethink and redesigned their pedagogies. The follow-up interviews with teachers were used to document how teachers make use of tablets in their classrooms and categorize the types of teachers' conflicts and tensions concerning the emergent teaching and learning practices (i.e. reflections about their pedagogies and didactical design in practice) in new materiality. This was an additional component of the study.

3 Research design and methods

The research presented is part of a broader project concerning the role of tablet technologies in educational design in Poland. In order to broaden knowledge about emergent practices in the tablet-mediated classroom and how they change over time, we conducted empirical research in a primary school located in a city in the region of Pomerania, northern Poland.

The research was a part of a project supported by the National Science Centre, and its aim was to describe and analyse emergent teaching and learning practices in the tablet-mediated classrooms. The topic of our research was the teachers' struggles to incorporate tablet technology in the classroom's teaching and learning practices. We had an insight into unique data. We could observe the initial stage when tablet technology was introduced into the school, that is why our study does not only reveal the emerging teaching practices in movement but also entire tablet technology implementation processes.

Listed below are the two research questions:

- RQ 1: What is the map of teaching and learning practices over the course of three semesters during the process of introducing tablet technology into a school?
- RQ 2: How do teachers define new technology-related dilemmas in their teaching practices?

Together these elements have covered the empirical study design (Table 1).

3.1 Context of the study

Conservative educational culture frames teachers' and students' practices in Polish schools. The external testing, hierarchical view of knowledge and ascetic, technology free learning environment are the dominant features of educational system in Poland. The primary school pedagogy is transmissive, largely teacher-centred with whole class teaching, frontal, direct instruction, and explaining. Students' learning is dominated and overshadowed by teacher-centred instruction. Students are expected to memorise information and reproduce the knowledge provided by the teacher. Technology is not integrated across the curriculum. "Pen and paper" are considered to be an optimum learning infrastructure. The only legitimate places for technology are IT classes.

3.2 School selection and sampling

The school we selected for the research was chosen because in 2015 it invested in wireless internet connectivity and purchased Air iPads (with their own financial means) that were to be used as part of the 1:1 model.

Table 1 Empirical study design

Theoretical framework	Research questions	Research methods	Unit of analysis	Goal of analysis
Didactical design SAMR model	RQ1	Video-ethnography	Observed teaching and learning practices	Identification of the emergent changes in teaching and learning practices
Teachers' reflections about their pedagogies and didactical design in practice	RQ2	Narrative: The follow-up interviews with teachers	Teachers' discourse: conflicts and tensions concerning teaching and learning practices	Identification of conflicts and tensions at the particular stages of didactical design in practice

Table 2 Sample structure – teachers

Teacher symbol	Age
T1 (mathematics)	59 years
T2 (Polish)	58 years
T3 (IT)	45 years
T4 (English)	34 years
T5 (science)	29 years
T6 (religion)	27 years

For the purposes of our research, we selected teachers who volunteered to conduct classes using tablets. They are all women and their professional teaching experience ranged from two to more than 20 years. In this school, women constitute more than 90% of the teaching staff. A detailed structure of the sample is provided in Table 2. The subjects represented various school subjects and domains of knowledge.

Teachers were informed about the procedure, conditions and timing of the empirical research. The collection of empirical data began in September 2015 and was completed in December 2016. The qualitative approach of video-ethnography was selected as the leading one in our research.¹ The follow-up interviews with the teachers whose classes were recorded were a source of significant supplementary data. The interviews were conducted three times and accompanied each class filming session in each semester.

3.3 Data collection methods

We participated in the collection 63 classroom observations documented with field notes and videos showing lessons (63 teaching hours of video material) over three school semesters. During this time, the same groups of students (two class teams) and the same teachers (6) were observed, which made it possible for us to maintain a certain continuum and to document real changes in the ways tablets were used in the classrooms within the existing framework and in the long-term. Our aim was to understand the emerging “practice architecture” (Kemmis 2019) and its possible change over time.

Video-ethnography as the primary method of collecting empirical material (Derry et al. 2010), and it was supplemented with follow-up interviews with the teachers (Marton 1981) that were repeated three times ($n = 18$). Each teacher interview lasted for about an hour. They were conducted in Polish. Each interview was recorded and transcribed. Excerpts of the interviews were translated into English. Data that could facilitate the identification of the teachers were anonymized.

A detailed review of the data collected divided by semesters is presented in Table 3. Operationalisation of the adopted theoretical models – developing coding schemes. We had two types of empirical material at our disposal:

- substantial video material showing objective actions of teachers and students in the classroom space (practices);

¹ Using video ethnography required fulfilling ethical requirements that included obtaining parental permission to film the children and developing a protocol for storing and processing visual data and maintaining the privacy of facial images.

Table 3 Data collected at school divided by semesters

Teachers	Semester I		Semester II		Semester III	
	Video-ethnography (teaching hours)	Number of interviews	Video-ethnography (teaching hours)	Number of interviews	Video-ethnography (teaching hours)	Number of interviews
T 1	4	1	4	1	4	1
T 2	4	1	4	1	4	1
T 3	4	1	4	1	3	1
T 4	4	1	4	1	3	1
T 5	3	1	3	1	3	1
T 6	3	1	3	1	2	1
Total	22 teaching hours	6	22 teaching hours	6	19 teaching hours	6

- a corpus of narration related to the teachers subjective experience, understanding and assessment of tablet-mediated learning (discourse).

The coding scheme originated from the didactical design (Dylak 2013) extended in the SAMR model, from which the names of the analyzed categories were taken (from A to G). Then, based on knowledge of the stages of transition from conservative (transmissive) to progressive education and the possible stages of the integration of technologies in the classroom, values on a scale from 1 to 5 were assigned that symbolized identifiable and separate ranges of the practices of teachers and students and how technology was used during classes. The lowest values (1 and 2) corresponded to the transmissive (conservative) logic of the Polish school with its concentration on “closed” knowledge, and textbook and memorization related actions. In these contexts, technology was clearly imposed on the order of the transmissive orientation of the Polish school. The value 3 referred to transition: attempts at stepping beyond the transmissive school logic in the analyzed scopes of practices, although, at the same time, it was marked by high teacher pressure and increased control (as expressed in the teacher’s frequent messages such as “you must” and “you must not”). Values 4 and 5 referred to the construction of learning situations outside the framework of the transmissive, conservative logic of the Polish school. These were attempts to create learning situations that engaged the cognitive curiosity of the learners, their independent thinking and analytical skills and cooperation in groups (Klus-Stańska 2011; Klus-Stańska 2012).

A larger research team discussed both the shape of the seven main categories and the defined areas of possible variation within categories. The coding scheme containing the area of variation of the observable practices is represented in Table 4.

3.4 Methods of analysis for the narrative data

We applied qualitative thematic analysis to process the interview data and focused (in compliance with the adopted theory) on the dilemmas verbalised by the teachers. The follow-up interviews were open discussions between the us and the teachers about the

Table 4 Coding scheme

Category	Description of the coding scheme adopted
A. Type of learning objectives adopted	<ol style="list-style-type: none"> 1. unclear, coverage of the lesson topic 2. provision of knowledge, consolidation of knowledge/ skills 3. search for information and its use within the framework defined by the teacher 4. search for information and its independent processing, recontextualisation, etc. 5. production of knowledge in a new form/shape
B. Type of learning practices implemented	<ol style="list-style-type: none"> 1. individual viewing of illustrative materials (presentation prepared by the teacher) 2. individual/group exercises, consolidation of skills 3. individual/group activity consisting of reorganizing knowledge under the teacher's control 4. group activity consisting of processing knowledge autonomously from sources indicated by the teacher 5. group activity consisting of processing knowledge
C. Use of didactic resources	<ol style="list-style-type: none"> 1. domination of textbooks; tablets used for displaying materials 2. domination of textbooks, applications closely subordinated to textbook material 3. breaking textbook monopoly through a multitude and variety of applications 4. breaking textbook monopoly through applications designed to reorganise knowledge 5. use of applications for producing knowledge and balancing textbook knowledge
D. Student role	<ol style="list-style-type: none"> 1. recipient of ready educational content 2. exercising and consolidating supplied knowledge and skills (memorisation) 3. reproducer of educational content with elements of independent knowledge processing using an indicated source 4. reorganising knowledge, transforming and group negotiation of knowledge, opinion expressing skills 5. group transformation of knowledge, independent search for materials and information and assessment of sources, cooperation with and involvement in the learning team, negotiating ways technology can be used
E. Teacher role	<ol style="list-style-type: none"> 1. expert, controls short time of activity with tablet through additional procedures 2. expert, limits tablet use time and controls the correct use of applications, provides technical support if necessary 3. expert-controller with elements of facilitation, supports learner involvement, provides substantial and technical support to learners, strong relationship of control of the learning process 4. consultant, monitors subsequent stages of group work, provides feedback

Table 4 (continued)

Category	Description of the coding scheme adopted
F. Assessment and feedback	<ol style="list-style-type: none"> 5. companion, observer (mentoring elements) of the learners' independent actions 1. no feedback, no assessment 2. comments concerning lessons, a general summary 3. assessment addressed to an individual or group concerning the result of work 4. assessment and feedback during particular stages of individual or group work and after the end of work 5. assessment criteria announced at the beginning of classes, feedback at subsequent stages of work, assessment after end of work, elements of advisory assessment
G. Goal of using technology in the classroom (the essence of "technology tasks")	<ol style="list-style-type: none"> 1. making knowledge transmission more attractive 2. substitution – streamlining 3. extension – improvement 4. modification – considerable change 5. redefinition – transformation

recorded class, and one of the questions posed referred to the dilemmas the teachers were having with integrating technology into their lessons. During analyses, only those dilemmas that were mentioned by all of the teachers in a given semester were taken into consideration. Thus, the criterion of the strength of the dilemmas that appeared in a given semester of the research was applied.

3.5 Coding procedure

3.5.1 Video-ethnography material collected

Every hour of the material viewed consisted of a recording of one lesson. After watching it, we coded it based on the list of categories (A-G) ensuring that the code selected best represented the character of both the recorded material and the actions observed. We performed the coding independently, which increased the reliability of the process. With a very few exceptions when there were differences in the code ascribed, we agreed on a common ground and introduced corrections. This referred to just four videos from category A.

The analysis of the video-ethnography material was performed using the following four steps:

- Applying a coding scheme to all the video material.

This step resulted in ascribing code values to each video of each teacher.

- Calculating the median values in the particular categories for the particular teachers for each semester (from I to III).

By maintaining the division by semesters, we obtained three collective tables (one for each semester) that present the median values obtained by the teachers Table 5.

- Placing median values obtained by teachers on diagrams for each semester.

The next step of the coding scheme was to place the calculated median values on diagrams representing the three semesters during which our research was conducted. The first comparisons were also performed; initially, the areas of the most and least considerable changes in the observed practices of the different teachers were identified.

- Analyzing transformations in teachers' practices.

Before performing analyses for this dimension, we determined the thresholds of the median values defining the boundaries of the orders in which the teachers' practices were located.

We identified median values between 1.0 and 2.0 as practices representing the order of the transmissive school. Here we saw confirmation of the values of the heretofore existing culture of education in which technology is strictly subordinated.

Table 5 Median values obtained by teachers

Semester	Categories (coding scheme)	Median values obtained by teachers (T)					
		T 1	T 2	T 3	T 4	T 5	T 6
First	A	1.5	1.5	1	2.5	1	2
	B	2	2.5	1.5	3	1	3
	C	2	2.5	1	3	1	2
	D	1.5	2.5	1.5	2.5	1	3
	E	2	2.5	1	2.5	1	2
	F	2	2	1.5	2	1	1
	G	2	2	1.5	2.5	1	2
Second	A	2	2	2	3	2	1.5
	B	2	3	1	3	2	2
	C	2	3	2	4	2	3
	D	2	2.5	1.5	4	2	3
	E	2	3	2	4	2	3
	F	1	3	1	4	1	2
	G	2	3	2	4	2	3
Third	A	2	4.5	2	5	4	2
	B	2	4.5	2	5	3	3.5
	C	2	4.5	2	5	3	3
	D	2	4.5	1	5	3	3.5
	E	2	4	2	4	3	3
	F	2	2.5	1	3	3	1
	G	2.5	4.5	2	4	3	3

We defined median values ranging between 2.5 and 3.5 as tension areas that were part of the existing culture of education and in which the first serious “cracks” appeared in its practices where new teaching and learning practices were emerging.

We recognized mean values ranging between 4.0 and 5.0 as symptoms of the culture of education experiencing a progressive transformation, with new teaching and learning practices appearing relatively frequently in connection with the successful integration of new technologies.

3.5.2 Narrative material from interviews

After reading the transcripts of the teacher interviews several times, we commenced coding and identified conflicts and tensions the subjects had to face at different stages of their struggle with digital technology in the classroom. The procedure for analyzing the material from the interviews consisted of the following two steps:

- identifying the content of the conflicts and tensions expressed by teachers at various stages of their didactic design.

During this step, we analyzed the teachers’ transcribed utterances collected after the recording of the lessons they conducted in the three semesters.

- comparing the teachers’ tensions and conflicts emerging at different stages of didactic design during the three semesters of the empirical research and referring them to the diagrams of the emergent teaching and learning practices.

This step led to the creation of a complete map of objective teaching and learning practices and the subjective meanings the teachers ascribed to these practices. However, most importantly we traced the process of changes in practices and meanings over time. Therefore, we can say that the maps created document the school community’s stages of learning. In other words, the maps show both the teacher’s didactic practices that were observed and their changing discourse.

4 Findings

This section presents the results of the video-ethnography research in diagrams, or maps, of emergent teaching and learning practices in the classrooms during the three semesters of our analyses. The diagrams were created based on the coding that referred to seven categories, and they are complemented by the teacher discourse that expressed their dilemmas, doubts and concerns regarding particular aspects of their work in the classroom after the subsequent cycles of research. As signals that accompany changes, the dilemmas are important elements of the analysis presented. In other words, we present the results of the interpretation of two analytical units for each semester of the research: the emergent teaching practices and teacher discourse.

We retained the time axis since it is significant for the emergent changes in the teaching practices in the tablet-mediated classroom. Each research cycle was provided

with a title reflecting the gist of the problems that appeared in the classroom. These titles were drawn from the analysis of the interviews with the teachers and refer to categories that appeared most frequently during the teachers' discourse at given stages of the research.

The three subsections designated show three clear stages of changes in teacher didactic practice associated with the appearance of iPads in the classroom. They also document the progress made in teacher practices and in their understanding of the new tool and its educational functions. These are the stages that happened following the “wow effect” that refer to teacher expectations that the mere introduction of the iPads in the classroom would be “miraculous” (T2). Teacher progress can be defined as a gradual shift in teaching practice and understandings of the educational role of iPads from “magic wands” and “toys” to “tools” that can be used to realise the aims planned by the teachers.

4.1 Teachers' disappointment

For the majority of the teachers, the first semester of research in the classroom revealed that they experienced disappointment and the conviction that iPads “are a failure in the conditions of Polish schools” (T5). The teachers considered the investment in purchasing the iPads as not having been fully considered. We are convinced that the main problem evident in the first semester of the video ethnography analyses consisted of attempts to fit the new tool into the framework of existing practices and activities and subordinating it to them.

Diagram 1. shows that teaching practices were almost entirely contained within the order of knowledge transmission. The collective table for this cycle of analyses shows that almost all of the teachers' results ranged from 1.0 to 2.5. Only one teacher participating in the project, the English teacher, exceeded the threshold determined as transmissive. Staying in this framework can be interpreted as a process that was independent of the teacher's age and his/her personal attitude (positive or negative) to digital technologies.

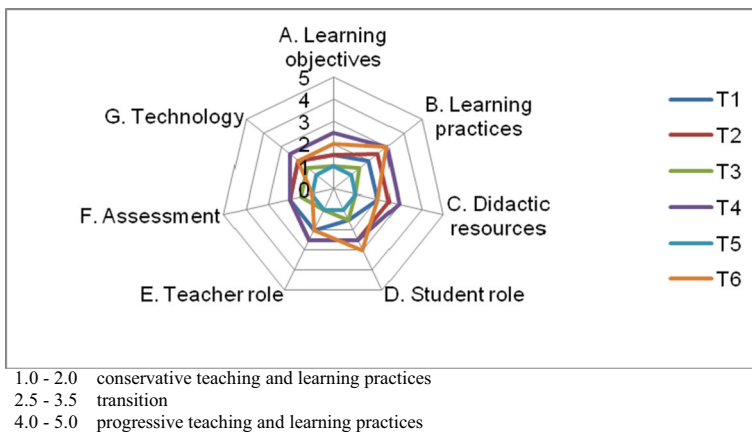


Diagram 1 Map of emergent teaching and learning practices (semester I)

A. Type of learning objectives adopted Most often these included the transmission and consolidation of knowledge or training specific skills. Educational goals were not always clearly determined by the teachers. They were most often related to the execution of the subsequent lesson topic, about which the learners were informed at the beginning of the lesson, while the range of skills and exercises to be done was not announced at all.

B. Type of learning practices implemented During the first semester, the learners used iPads most often to watch illustrative materials (excerpts of videos or presentations prepared by the teacher). In this sense, the learners' iPads were transformed into small, mobile TV sets, on which they could watch a video or a presentation at their desks (these presentations were also always shown on interactive whiteboards). During mathematics, English and religion classes, learning practices were more clearly connected with exercising and consolidating skills either individually or in groups (for example, practicing addition and subtraction skills for a fixed period of time, followed by the comparison of results).

C. Use of didactic resources The teachers considered textbooks and workbooks to be the leading resources of knowledge and skills. The applications selected by the teachers were strictly subordinated to the leading didactic materials (most often a single type of mathematical operations or a certain defined group of English vocabulary were improved).

D. Student role In their actions, the learners did not step beyond being passive recipients ready for knowledge prepared by textbook authors and their teachers. They played a more active role while improving skills, when they were expected to perform efficiently, quickly and correctly. The scope of their activity was dominated by actions related to memorising and consolidating knowledge.

E. Teacher role During the first stage of our research, the teachers did not go beyond the role of experts transmitting knowledge or equipping learners with skills. The teachers had an additional task to perform, namely to organise activities during which iPads were used. This included distributing the devices to learners, controlling the time determined for the selected activity and ensuring that the learners did not use any other applications available on the devices.

F. Assessment and feedback In this cycle of the analyses, assessment and feedback practices were presented sporadically as general summaries of the classes. It was often the case that the element of assessment and feedback for learners was entirely absent.

G. Goal of using technology in the classroom (the essence of "technology tasks") It seems that the goals of the lessons analysed could well be achieved without iPads since the devices were reduced to the role of a substitute screen for displaying video material. The tablets were used during very short, clearly limited time spans of up to 10 min. During this time, the learners had a chance to improve concrete skills such as addition, note-taking or consolidation of English vocabulary. The use of technology did not move beyond a narrowly understood substitution and streamlining of the heretofore learning actions undertaken.

Analyses of the content of the interviews revealed some dilemmas defined as primary contradictions that concerned the gist and sense of including tablets in the teaching process. All the participating teachers expressed such doubts. First, they focused on the impossibility of fully subordinating technology to the textbook, which was the leading source of knowledge. The dilemma was summarised in the question of whether tablets were toys or educational tools. The presence of tablets in the classroom was a great challenge for the teachers, and it was the source of serious doubt, which is why the teachers focused only on their own fears, anxieties and uncertainties regarding whether and how tablets might serve the aims of lessons. At this stage of the research, the teachers were essentially ready to discard the tablets as “toys” that were incompatible with the aims of the school. These dilemmas were drawn from the interviews with the teachers in the first semester. They are illustrated by the following examples of teachers’ statements.

Teacher T1: I understand that now we need to teach in a more modern, more active manner and through play, but mathematics is one of the most serious subjects. Of course, I can use mathematical applications to consolidate simple operations but nothing more. A tablet cannot replace textbooks or workbooks.

An important dilemma is also related to the time designated for the design of classes involving iPads. The teachers did not anticipate that this activity would take so much time, and additionally they found it hard to identify applications that were synchronised with the textbook.

Teacher T5: I must say I was very disappointed. There are so many applications, and I have no time to look through them. And there are no applications that fit the material from the science textbook for my class.

Teacher T4: In the case of English, I can see many possibilities for using iPads in the classroom. There is a huge number of applications, but the selection of the right applications and checking them takes much too much time. Recommendations on websites are not always reliable. Apart from this, I have to try out a given application myself before a lesson. I did not think that classes with iPads would be so demanding or that they would require so much time. It is true that such lessons are involving, but at what cost...at the cost of my time!

It is worth noting that the teachers’ dilemmas clearly concern the teachers’ activity zone. Under this optic, the learner’s perspective is absent from the teachers’ discourse. The presence of tablets in the classroom was a great challenge for the teachers and a source of great doubt, which is why they focused only on their own fears, anxieties and uncertainties concerning whether and how tablets can be subordinated to the goals of lessons. At this stage of the research essentially the teachers expressed their willingness to discard the tablets as “toys” that were incompatible with the goals of the school.

4.2 Teachers’ encouragement

The subsequent cycle of the research can be referred to as the critical period during which some teachers worked diligently to change their own teaching practices (results of 2.50 and above). For others, however, it was a period in which they continued using the new tool marginally while highlighting the “incompatibility” and

“inappropriateness” of iPads for teaching their subjects (teachers of mathematics, IT and science – their results were still below the 2.50 threshold). The results are presented in Diagram 2.

A. Type of learning objectives adopted The dominant types of educational goals were still related to the provision of knowledge or skills and their consolidation. These goals were not at all verbalized during classes or were expressed just before the task commenced. However, the Polish and English teachers began to formulate them more clearly around the model of information search and processing.

B. Type of learning practices implemented For some teachers, the learning practices were still tantamount to the consolidation of knowledge or practicing skills. Nevertheless, some teachers started to create more opportunities for learners to search for and process information independently. However, this type of activity remained under the control of the teacher, and the Polish, English and religion teachers indicated the sources (website addresses) to be used. Most often, the learners prepared presentations in groups by looking for appropriate information and supplementing it with illustrations.

C. Use of didactic resources For some teachers, the textbook was still the basic source used during lessons, and work on tablets was of marginal importance. In the case of three teachers, there was a notable change: the iPads were not only used for most of the work during the lesson, but sometimes they marginalized the use of the textbook. Only during one English lesson was the textbook not used at all when the learners were involved in group work to prepare presentations on Commonwealth countries.

D. Student role During the lessons under analysis, the learners played both the traditional roles of performers of practical actions such as efficient counting, copying pages and making tables (working with the *Pages* and *Numbers* applications during IT

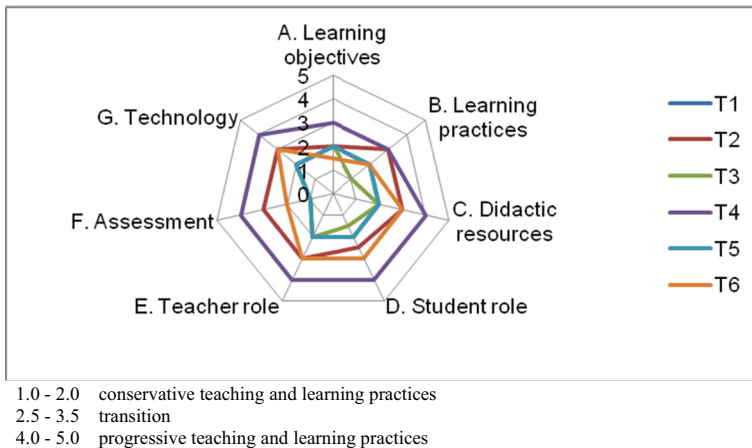


Diagram 2 Map of emergent teaching practices (semester II)

classes) and active roles when they searched for information and negotiated how to elaborate it and present it in groups.

E. Teacher role A clear division was observed in the teachers' roles. On the one hand, the traditional teacher role as the expert who determines and controls the short time span for tasks using iPads (the iPads were then taken away from the learners) was strongly marked. On the other hand, some teachers introduced a certain change to their role as the expert by supporting stronger learner independence and involvement in group work. These teachers tried to facilitate solving tasks rather than to impose ready solutions. However, this new emergent role was limited by former habits, as many instructional elements such as "you must" or "you must not" appeared in communications between teachers and learners. These underscored the strong controlling tendencies of the teachers concerning the manner in which the tasks were to be performed and their expected effects.

F. Assessment and feedback Teaching practices at this stage of our research were marked by considerable inconsistency, because in the majority of cases there was no assessment or feedback at all. If there was assessment it was limited to very general summaries of lessons, which provided very unclear information to individual learners. The English teacher presented an entirely new model of assessment, which involved providing feedback during group work (after each stage of the work was completed) and after the completion of the work (assessment of the work result).

G. Goal of using technology in the classroom (the essence of "technology tasks") Technology continued to be used mainly at the basic level of substitution, without functional changes, when learners prepared a project using applications such as *Mind map* (making notes of their ideas in the application instead of on paper) during a single stage of their work and then developing presentations using the *Keynote* application. The learners' preparation of questions and answers for a game in the *Kahoot* platform (religion class) also failed to exceed the logic of substitution. (The learners prepared materials on paper then the teacher asked them to write a few selected questions and answers on the platform indicating which were the correct answers. The teacher concluded the task at this stage without giving the quiz). Some teachers reached the level of augmentation, which meant that using the device led to a significant reconstruction of school tasks. For example, through their use of the *PlayDoh Touch* application (elements made from PlayDoh are scanned and digitally repeated as an element of a story in a digital picture book), taking a quiz (with immediate feedback for the groups participating in the competition), or the use of the *Big Challenge* application. In English lessons, technology began to transform learning practices significantly because some types of activities such as recording dialogues, making short videos of conversations, linking written forms of words with their meanings and correct pronunciation (using the *Aurasma* AR application), etc., would not have been possible without it.

The teachers' dilemmas that emerged in this cycle of our research were clearly located at two levels: the first referred to the new tool and the old object (for most teachers) and, for some teachers the second referred to the new model of activity and the remains of the previous one (learner independence vs. teacher control). The differentiation of dilemmas that was noted at this stage of the research was the effect

of the “dispersing” of emergent practices in the school classroom. The teachers who persisted in the transmission mode attempted to subordinate the new tools to previous practices. Teachers who had made changes in teaching practices, however, shifted their concerns to a new level that identified unresolved dilemmas with regard to learner independence and teacher control. This marks the point at which the learner perspective clearly appears in the teachers’ thinking for the first time. The student perspective appeared in teacher discourse along with the shift in the definition of tablets. They ceased to be “toys” and became “tools” that mediated between the teachers and the learners in the school classroom. The teachers no longer defined the iPads as “toys”. In their eyes, they had achieved the status of “tools” that were appropriate for learners to use to process and produce information. Nevertheless, the teachers did not always perceive these activities as indispensable to the teaching of their subjects.

Teacher T1: Generally speaking, I can see considerable possibilities for working with iPads at our school, but not in mathematics classes. Here, I would definitely discourage anyone from using them. For simple calculation-based exercises, yes, but I can already see the fatigue effect. There is no “wow” factor any more, and the iPad no longer makes them happy as it did initially.

Teacher T3: PC-based work, however, provides a much larger field for practice, while iPads are specific and do not provide such opportunities. Everything is intuitive, simplified and schematic. Of course, I will use them sometimes, but personally I cannot see any considerable possibilities for learning anything new.

Other teachers expressed certain fears related to the new type of action and the former practices in the area of controlling learner activity. The following statements confirmed both the new teaching practices in classrooms and the new dilemmas that accompanied them with regard to the possibilities of monitoring dispersed groups of learners.

Teachers T4: I can see the significant value in using iPads during English lessons. The children have more motivation, but I catch myself struggling. The kids work in small groups, using diversified material, at different speeds, and they often need my help. There is only one me, but I would like to get everything right.

Teacher T6: Until recently I mainly assessed the result on a good/poor basis, but now we have many additional things that I have to take into account such as involvement and willingness to cooperate. This also needs to be assessed somehow, but I don’t have any idea of how to do it yet.

4.3 Student-centric progressive teaching

The last cycle of research conducted in the third semester was, on the one hand, marked by efforts to deeply reconstruct teaching practices in connection with the appearance of technology in learning (with results above the 3.5 threshold), while, on the other hand, our research revealed that some teachers did not manage to reorganize their practices and continued obtaining results that fit the logic of knowledge transmission (i.e., below the 2.5 threshold) in the same period under analysis. The collective results are shown in Diagram 3.

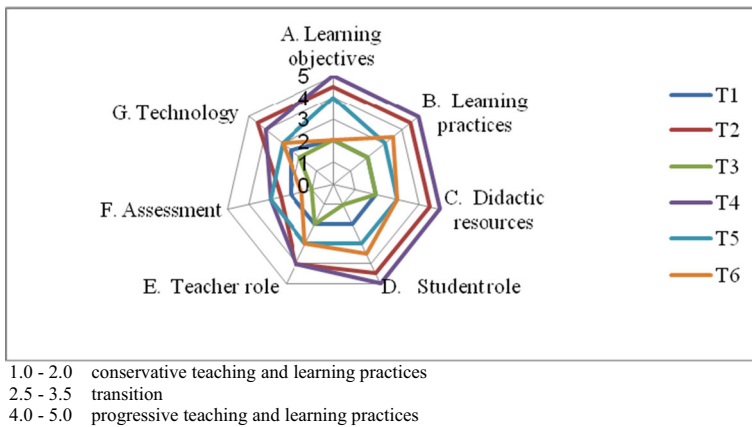


Diagram 3 Map of emergent teaching practices (semester III)

A. Type of learning objectives adopted On the one hand, educational goals were not at all verbalized or were signaled unclearly, but the new teaching practices unambiguously included those covering clearly defined goals related to learner independence as creators of knowledge (results of 4 and above in category A).

B. Type of learning practices implemented Learning practices continued to include well-established individual exercises based on many fast repetitions (mathematical applications). The emergent new practices doubtless included group activities consisting of the independent, negotiation-based creation of knowledge by learners from sources indicated by the teacher or from other sources. What was appreciated here was the learners' personal knowledge and experience.

C. Use of didactic resources Strategies for using available resources were also very diverse. On the one hand, we noted the dominant role of the textbook, but there were also some clear attempts to break down this domination by balancing and multiplying sources. From the point of view of the process of the construction of knowledge by the learner in connective contexts, this emergent practice is of huge significance (results above 3).

D. Student role In this category both the traditional role of the learner as the recipient of ready knowledge (results below 2.5) and the emergent new framework of the learner roles were identified. The learners benefited from being causal agents in processing or creating knowledge. This reorganisation of the learner role consisted in granting them a higher degree of independence and appreciating their technical competence, which resulted in the mandate for the creation of their own content.

E. Teacher role What was identified in this category was both a conservative tendency, which was the teachers' attachment to the role of the expert transmitting knowledge (results below 2.5), and efforts to change this role. By acknowledging the learners higher agency in the area of knowledge creation, the teachers "shifted" their own role towards that of consulting and mentoring practices, which facilitated the emergence of new teaching practices (results of 4.0 and above).

F. Assessment and feedback Surprisingly, all the teachers obtained results that marked them as rather traditional (results below 3.0), which meant that assessment and feedback practices were not a highly reconstructed aspect of their practices. Although there were single cases of evaluation in stages, assessments most often concerned the effects of work or the teachers limited themselves to a general summary of the classes. From the point of view of learners' independent construction of knowledge, this collection of teachers' practices raised concerns since it left learners without adequate feedback on the quality of their work.

G. Goal of using technology in the classroom (the essence of "technology tasks") In this category, we see both the use of technology in substitution and augmentation models (i.e., the frequently applied game-based approach such as the *Kahoot!* application that was used to check learner knowledge), but also clear attempts to modify learning practices through technology (designing books using *Book Creator* and designing presentations to explain natural phenomena with *Aurasma*). *iMovie* applications that combine narration, image and sound were also used. Teachers also developed visual competences and algorithmic thinking through the practice of changing a tale into a game plot (*Bloxels* application) and other narrative games. Interactive books, which appeared during this cycle of our research (such as *WuWu* in English classes) were also used frequently.

Speaking in more detail, the teachers were concerned about how the new teaching and learning practices were going to meet the requirements of the education system when the learners changed schools in later stages of education. These conflicts and tensions concerned solely student knowledge and its adequacy with regard to the requirements of the education system.

Teacher T4: The worst thing is that no one will ask them [the learners] whether they can design a game or make a video on *iMovie*. They will be assessed based on the results of tests, so we always need to keep a balance between their passions, involvement, new technologies and the merciless tests, from which there is no escape.

Teacher T2: We attempted something we had not been aware of. Now, our school is upside down, we do everything in a different way and this greatly benefits the learners, who are no longer bored and who have begun to learn automatically. There is just one thing, the tests at the end of sixth grade. This could be a painful experience for the learners. No cooperation, no Internet, just a piece of paper and a pen.

The teachers who went the farthest in reconstructing and changing their teaching practices expressed teaching conflicts at this stage of the research concerning the incompatibility of new teaching and learning practices with the requirements of the traditional teaching system that their school was a part of. These are included in the following statement: the approach centers on learners as knowledge creators and the mere production of knowledge in situations with technological mediation reached beyond the materiality that is assumed in the Polish education system that is based on "pen and paper". The teachers were, therefore, aware that their practices had great transformational potential. However, this applied only to their particular school.

5 Discussion

Our analyses document two processes taking place in the school. We identified a slow shift from the logic of transmissive teaching to practices focused on learners and their learning. This was observed in emergent practices such as the organization of group-learning situations, the reorganization of knowledge, indicating alternative sources of information, using new strategies for assessing the creation of new reference frameworks of the learner's role and a more comprehensive use of technology. We identified the transfer process by analysing the order in which the teachers expressed the conflicts and tensions. Initially, these included teacher work time and their involvement and the entertainment (and thus not educational) role of the iPads. Although the teacher's opinions of the iPads subsequently evolved to a recognition of them as educational tools, the teachers still harbored concerns about the educational value of learner knowledge and their technically mediated skills from the perspective of education system requirements. We also perceived that the practices of assessing and providing feedback on learner projects, the reconstruction of which was the weakest aspect of the emergent practices, were somehow related to this "empty space" in the Polish system of education. Assessment and feedback on the effects of learning are more likely to be relegated to anonymous instances within the education system that is responsible for administering final testing than to the teachers who accompany learners daily in their learning.

The most significant conclusions resulting from our study concern:

- change of the subjective meanings given to technology at the subsequent stages of our study by the teachers

Initially, the teachers perceived tablets as "magic wands", then as "toys" having no educational potential, and finally as "educational tools" in their own right, which find their place in school materiality. However, it is impossible to determine whether the new meanings of tablet technology are becoming a source of new practices, or whether the emerging new teaching and learning practices are becoming a source of new meanings of tablet technology.

- slow emergence of new teaching and learning practices, finally accompanied by a deep reconstruction of the conservative pedagogy and the shift of the direction towards the pole of the progressive teaching practices

This shift applies to the following dimensions:

- from transmission of ready knowledge towards search for knowledge in group processes
- from an approach based on the "guessing" or "recollection" of the correct answer towards the process of joint exploration and discussion of various solutions
- from the transfer of certain, ready and constant knowledge towards uncertain, fragmentary, liquid knowledge
- from learning from the teacher's knowledge towards problem-based learning
- from memorisation of information towards information processing
- from reproduction towards creativity and innovation

However, we cannot disregard the existence of teachers who made some other choices within the scope of their own practices and indicated an “incompatibility” between the tool and their subject area. The key to understanding the reserved attitude about the fuller use of iPads during mathematics and IT classes is the package of skills defined in the core curriculum for primary school for these subjects rather than the teachers’ personal deficiencies or their decision to marginalise the use of tablets. In other words, we could not conclude that the teachers who did not reconstruct their own practices progressively did not understand technology. They understood the programme requirements for their subjects, and these prevented them from a more intense use of tablets in teaching. Because of the core curriculum requirements, both the mathematics and IT teachers used the new tool marginally and rather infrequently; however, they did not verbalise this fact and only hinted in general at the “unsuitability” of iPads. Both the mathematics and IT teachers tried to integrate tablets in their classrooms but decided to step back to the pole of traditional (conservative) teaching practices. Their strategy was tantamount to a marginal use of tablets during classes, reducing them to a lesson attraction and their exceptional, infrequent use. The teachers concluded that tablets as a new tool do not guarantee the results required by the core curriculum for their subjects. For this reason, the risk of the establishment of new teaching and learning practices seems to be too high for them. Educational goals are reached in a safer way when traditional methods are used and when the emergence of new practices is limited.

The recent emergence of pandemic-transformed pedagogy has forced teachers in Poland to experience a deep structural shift in thought and teaching practices similar to those identified in our study. The pandemic reveals that digitalisation of the school is an unavoidable process that challenges the established roles, hierarchies, resources and shapes the “new normal” of educational policy in Poland. Nevertheless the teachers’ practices are still at the centre of the interrogation.

6 Limitations

Our research was conducted at the request of the school administrators who indicated that their teachers were ready to participate in an engaging study and wanted to be provided with feedback on their practices. They consented to the presence of video cameras and the personnel who recorded their work. We know that some teachers at this school refused to conduct lessons with iPads, and they were necessarily excluded from the research. The presence of the cameras could also have caused some reservations among potential subjects since it was not only a convenient recording tool, but it was also a monitoring tool, which meant that knowledge regarding teaching practices could have been used variously including against teachers, and it could have led to the school director removing from teaching positions teachers who could not cope with tablet technology in their teaching.

Our research was conducted on small samples, and, therefore, its explanatory power is limited. However, it is a study of educational change performed on a micro-scale, which we perceive as its main value. Nevertheless, it would definitely be worthwhile to extend the scale of the research to include larger groups of teachers and school teams to track areas in which the changeability of practices is related to the same domains of knowledge.

7 Conclusion

The aim of this article was to show how new teaching and learning practices emerged in a technology-enhanced classroom. We did not make any assumptions as to the manner in which this transfer might happen or as to what the change might apply to when an active element such as tablet technology was introduced to the didactic design. Our study indicated that the great amount of diligent work that follow the “wow effect” which was a non-reflective expectation that the technology itself would produce educational effects without teacher involvement. We also presented teacher disappointment with technology and of the technology for assisting teachers, as well as contexts in which technology made it possible for teachers to develop new pedagogical approaches and to further reconstruct their own practices.

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Data availability This work protects the privacy of our respondents and the data collected is for this reason not available to others.

Compliance with ethical standards

Conflict of interest The present work does not present any conflict of interest.

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Code availability (Software application or custom code): N/A

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